Emilio Crocco

Southern New Hampshire University

CS-330 Computer Graphics and Visualization

Assignment 7-1: Project Decision Report

**Overview**

This write-up explains the main design choices I made while creating my 3D scene. The project features a bedroom nightstand with several objects and realistic lighting that work together to make the space feel natural and complete.

**Lighting Design Decisions**

I used a four-point lighting setup with key, fill, rim, and bounce lights to give the scene a natural and balanced look. This setup helped prevent harsh shadows while keeping all parts of the scene clearly visible from any angle. I chose a cool daylight color temperature, around 6500K, to mimic sunlight coming through a window instead of the warm yellow tone of indoor bulbs. The key light above the scene provides the main illumination, and the other lights fill in the darker areas, add reflections, and create depth. Their positions were adjusted carefully so the nightstand looks good no matter where the camera is placed.

**Material Design Decisions**

I selected materials that created contrast and realism between objects. The floor uses a matte finish to reduce glare, while the nightstand features two wood textures, one light and one dark, to add visual interest. The lampshade uses a pure white material to enhance brightness from the light sources. Each texture was scaled and oriented to fit the geometry of the object correctly, preventing any stretching or uneven patterns.

**Object Composition Design Decisions**

The scene is structured in a logical hierarchy. The floor grounds the scene, the nightstand acts as the main focal point, and smaller items such as the lamp, books, picture frames, and logs add balance and realism. The nightstand was built using simple shapes such as boxes and cylinders for its body, drawer, and legs. The lamp includes a box base, a cylindrical pole, and a box shade positioned slightly to the left to make the layout feel more natural. The books are stacked with small offsets, and the picture frames are arranged at different heights to add variation and realism.

**Custom Functions and Code Structure**

To keep the code efficient and easy to manage, I created helper functions such as CreatePictureFrameWithToruses(). This function simplifies the process of generating picture frames, ensures consistency, and makes updates easier. I also used constants for common position values to make future adjustments more readable. This modular design reduces repetitive code and makes it easier to reuse components in other OpenGL projects.

**Performance and Optimization**

I limited each object to fewer than 1,000 triangles to keep the scene running smoothly. Meshes are loaded once and reused across multiple draw calls to reduce GPU load. I added small positional offsets between surfaces to prevent z-fighting, which helps maintain smooth depth rendering and keeps overlapping textures from flickering.

**Navigation and User Interaction**

The user can move the camera using the keyboard and mouse. This allows for rotation, zooming, and panning around the scene to view objects from multiple angles. The camera settings were tuned for smooth, responsive movement, giving users an intuitive way to explore the lighting and material details from different perspectives.

**Visual and Aesthetic Choices**

I chose a warm and natural color palette to create a calm and welcoming atmosphere. The reddish wood floor complements the neutral tones of the nightstand, while the lamp and books add subtle pops of color. The picture frames use transparent glass with about 40 percent opacity to simulate gentle reflections. Together, these elements create a realistic, home-like feel that emphasizes lighting and texture detail.

**Conclusion**

The finished scene combines creative design with technical precision. Every lighting, material, and layout choice supports a realistic and efficient final product. This project demonstrates a solid understanding of OpenGL rendering, scene organization, lighting design, and performance optimization, all of which reflect professional standards for 3D visualization.